

The aurora observed on the evening of February 26 at Washington, D. C., was reported to have been accompanied by a severe disturbance of the telephone lines, but a special report from Mr. Samuel M. Bryan, President of the Chesapeake and Potomac Telephone Company, states that this disturbance was due to the telephone lines being rendered useless by the grounding of a heavy electric-light circuit, so as to seriously impair and in some cases totally destroy the efficiency of the underground system.

CANADIAN DATA—THUNDERSTORMS AND AURORAS.

No thunderstorms were reported.

Auroras were reported as follows: 1st, Minnedosa, Man., and Prince Albert, Sask. 2d, Quebec, Que., Minnedosa, Man., and Prince Albert, Sask. 3d, Minnedosa, Man. 7th, Prince Albert, Sask. 8th, Winnipeg, Man., and Prince Albert, Sask. 13th, Winnipeg and Minnedosa, Man., and Medicine Hat, Assin. 14th, Grand Manan and St. Andrews, N. B., Charlottetown, P. E. I., Father Point, Que., Toronto, White River,

Kingston, Saugeen, and Port Arthur, Ont., Winnipeg and Minnedosa, Man., Medicine Hat and Qu'Appelle, Assin., and Battleford, Sask. 15th, Halifax and Yarmouth, N. S., Grand Manan and St. Andrews, N. B., Charlottetown, P. E. I., Father Point, Que., Toronto, White River, Kingston, Port Stanley, Saugeen, Parry Sound, and Port Arthur, Ont., Winnipeg, Man., and Battleford, Sask. 16th, Halifax, N. S., Medicine Hat, Assin., and Battleford, Sask. 17th, Father Point, Que., and Kingston, Ont. 18th, Prince Albert, Sask. 20th, Father Point, Que., and Winnipeg, Man. 23d, Yarmouth, N. S., St. Andrews, N. B., Father Point and Quebec, Que., Toronto, White River, and Kingston, Ont., Winnipeg, Man., Medicine Hat, Assin., Banff, Alberta, and Prince Albert, Sask. 24th, Grand Manan, N. B., Medicine Hat and Swift Current, Assin., Banff, Alberta, Prince Albert and Battleford, Sask. 25th, Minnedosa, Man. 27th, Winnipeg, Man., and Esquimalt, B. C. 28th, Winnipeg, Man., and Medicine Hat and Swift Current, Assin.

METEOROLOGY AND MAGNETISM.

For general remarks relative to this subject see page 7 of the REVIEW for January, 1895.

The comparison of the air temperature with magnetic horizontal force is shown in detail on Chart V, and the special features of the February curves are as follows:

The temperatures of the Calgary, Williston, and Sioux City groups each need the correction—1 for slope. Washington is corrected for slope by +1; San Antonio is compensated for

amplitude by the factor $\frac{1}{2}$, and for slope by +2. The mean temperatures are reduced to a zero datum line by -8, and the mean magnetic force by +23. The new solar magnetic period begins February 13.12.

After about a full year has been exhibited in this comparison of temperature and magnetic force variations, it will be proper to make some comments on the relations of the two systems of forces.

INLAND NAVIGATION.

The extreme and average stages of water in the rivers during the current month are given in Table VII. The only river that approached the danger line was the Sacramento, which was rather high during the first part of the month.

The thickness of ice in rivers and harbors is given for each Monday of the winter months in the Weekly Bulletin of Depth of Snow on Ground. On Monday, February 25, the reports indicated the following conditions: In the Missouri River the thickness of ice varied from 33 inches at Williston to 16 inches at the mouth; in the Mississippi River, from 26 at St. Paul to 0 at Cairo; in the Ohio, from 6 at Pittsburg to 3 at

Louisville; in the Hudson, from 18 at Albany to 0 at New York. In the Lake region the reports were: Duluth, 26.5; Marquette, 17.5; Green Bay, 18; Grand Haven, 15; Detroit, 15; Toledo, 24; Sandusky, 12; Cleveland, 14; Erie, 18; Rochester, 22; Oswego, 17.5. On the afternoon of the 25th the ice was reported as breaking up and moving at Miles City, Mont., Hermann, Mo., and North Bend, Ind.; and in a few days after this much ice in the rivers had broken up.

On February 5, at Nyack, the Hudson River, which is three and a half miles wide at this place, was frozen entirely over for the first time this season.

STATE WEATHER SERVICES.

The following extracts relating to general weather conditions are taken from the reviews published by the respective State services:

Alabama.—The month was remarkable for the extreme cold periods, especially during the first week. The temperature at many stations was several degrees lower than ever recorded at that season. The average monthly temperature for the whole State was 12° below the normal. The snowfall was also heavier than ever known in this section during this month, the monthly fall averaging from a few inches in the southern portions to a foot deep in northern portions, where it was sufficient, on the 14th and 15th, to impede railroad traffic. The Weather Bureau's cold-wave warning of the 6th, which was very widely distributed, did much to avert damage to early trucking crops, but in southern portions of the State, where such crops were further advanced, a great deal of damage was done, and most of such in that section had to be replanted. Fortunately the cold has retarded development of sap in fruit trees, and the prospect for a bountiful fruit crop is now very favorable.

Arizona.—Temperature for the month nearly normal. Rainfall, for an average of 42 stations, about a quarter of the normal for February; 13 stations reported no precipitation.

Arkansas.—The monthly mean temperature for February was 13.2° below the normal, and was the lowest of which there is a record. From the 1st to the 17th the temperature was constantly 13° or more below the normal, the daily average deficiency for these days being 21.3°. The lowest temperature occurred on the 7th, which was the coldest day generally throughout the State. On this date the minimum temperature ranged from 4° above zero in the extreme southern part of the State to 17° below at Pochahontas. The average precipitation for the State was 0.73 inch, which is 3.61 inches less than the normal amount and the lowest average ever recorded for the State during February. A large part of it was in the form of snow, the total fall ranging from a trace in the extreme southern part to 7.00 inches at Hot Springs. The snow that fell on the morning of the 7th was accompanied by a fine black sand or drift soil, which must have been brought from some distance, as the ground was covered with snow when this fell. Reports of this snow dust were received from Silver Springs, Benton Co.; Keesees Ferry, Marion Co.; Ozark, Franklin Co., and Fayetteville, Washington Co. (See January Review, 1895, page 15).

California.—As compared with the normal temperature for this month, an excess of from 1° to 4° was reported from all portions of the State, while the precipitation was deficient. The excess of temperature and deficiency of rainfall have produced a wonderful effect

upon the growing crops, although in some portions of southern California and the San Joaquin Valley a few showers are desirable to break the crust formed by drying winds since the heavy downpours of January have ceased. One notable phenomenon for February is the blooming of almonds, peaches, plums, etc., for a distance of 500 miles north and south.

Florida.—The mean temperature for the current month is 12.6° below the normal for the State and 10.5° lower than the mean for February, 1894. At Jacksonville it was not only the coldest February since the station was established, but the coldest month in the history of the station, and, doubtless, this will apply as well to all stations in the State. The 8th was the coldest day experienced in Jacksonville since the Weather Bureau office was established in 1871, and on this same day the temperature fell below the freezing point at all stations in the State except Key West. More snow fell in this State during February than in any month since observations were begun by the Weather Bureau. At Moseley Hall the snow which fell on the 14th is said to have been the first in forty-three years; it also fell on the same day at Tampa; in Pensacola it was deep enough, according to newspaper reports, to permit the people to ride in sleighs.

Georgia.—This month has been noticeable for its low temperatures and heavy snowfalls. On the morning of the 8th the State was visited by an unusually severe cold wave, which brought the temperature down to zero, or below, in the northern districts and to 10° or 12° in the extreme southern counties and many other portions of the State. Several snowstorms occurred during the month when the amount of snowfall reported ranged from 2 to 8 inches. The average temperature of the month for the State as a whole was over 6° below the seasonal normal, while there was a deficiency of 1.28 inch of precipitation.

Illinois.—Seldom has Illinois experienced such severe and long-continued cold as during the first half of this month. From the morning of January 22 to the evening of February 16 the average temperature of the State was a fraction over 9° and the minimum temperature during the same period was very close to zero—a record which has probably been excelled but once in the past twenty-one years, i. e., in the winter of 1875. The average temperature of the month was 20.1° , or 9.8° below the normal. During the past twenty-one years but two Februaries have been colder than the one just passed, viz, 1875, 16.2° , and 1885, 18.6° , a fact which makes a marked 10-year period. The precipitation was by far the smallest ever recorded for the month of February. The snowfall gives an average of 4.1 inches. During the severe cold of January and February the ground was well protected by snow, and on the last of the month winter grain was in good condition. The melting snow was largely absorbed by the ground, and may, in a measure, remedy the great lack of precipitation.

Indiana.—Unusually cold and dry weather continued during this month, except on the last few days, when there occurred a slight, and on the 28th a great, excess of temperature. Precipitation occurred on only a very few days, nearly all in the form of snow, except on the last two days of the month, when occasional rains fell. The depth of snowfall ranged from 2.3 to 13 inches. Deep snow covered the ground on the 15th, but at the end of the month it had disappeared, except a few traces in the northern portion. On account of the protracted drought during the autumn and winter, wheat is only in fairly good condition and pasture poor; some wheat has been winter-killed; stock suffered much from the continual cold and scarcity of water. Peach and cherry germs are reported to be killed and farm work much retarded by the inclemency of the weather of the past two months.

Iowa.—The current month was unusually cold and dry. The mean temperature for the State was 16.4° , or 5.8° below the normal. The minimum temperature was below zero sixteen consecutive days, 1st to 16th, inclusive. The last week brought a marked change, with spring-like conditions, during which period considerable wheat was sown in the northern half of the State. The average precipitation was 0.93 below the normal. The snow disappeared before the end of the month, and nearly all of the moisture entered the soil. The number of storm days was somewhat below the average.

Kentucky.—The normal temperature for this State during the current month, as deduced from records of the Weather Bureau stations at Cairo, Cincinnati, Lexington, and Louisville, covering periods of from twelve to twenty-four years, is 40° , or 13° higher than the mean for the past February, compiled from the records of forty-three voluntary observers. The warmest period of the month was from the 24th to the 28th, and the coldest from the 5th to the 10th. On the 7th, 8th, and 9th occurred the severest cold wave since the commencement of systematic records in the State, and so far as known, the severest ever recorded for the season. As the ground was covered with from 4 to 6 inches of snow throughout the greater portion of the State, no damage to winter grain resulted from this intense cold. From many localities came reports of damage to peach trees, but it can not be estimated until later in the season. Other fruit trees escaped without injury. The mean precipitation, as determined from the same sources as the mean temperature, shows a large deficiency of 3.69 inches. The precipitation came mainly in the form of snow, which remained on the ground in most sections until the 20th.

Louisiana.—February, 1895, will go down in the history of Louisiana climatology as a record breaker for cold and snow. The mean tempera-

ture averaged 12° below the normal for the month, and 8° colder than the coldest February heretofore (1889). The cold may be said to have been continuous throughout the entire month, there being only five days when the temperature averaged normal, or slightly in excess thereof, for the day. The coldest weather occurred on the morning of the 7th and 8th; more particularly on the latter date in the southern half of the State, and no such cold was ever known before in February in Louisiana, and but once in any other winter month, i. e., January, 1886. Within a week after this extreme cold the ground was covered with a mantle of snow to a depth of from a few inches at the Mississippi jetties to as much as two feet in southwest Louisiana. The precipitation for the month averaged about a third of an inch less than usual in February for the State, the deficiency being due to the small amount received in the northern half of the State, where it averaged less than 40 per cent of the usual quantity.

Maryland.—This month surpassed in cold weather all previous Februaries, at least since the establishment of the Weather Bureau in 1870, besides making a record for dryness seldom equaled. The severest storm was the cyclone which passed northward along the middle Atlantic coast on the 7th; and it is safe to say that, with the exception of the "blizzard" of March 11, 1888, no storm that has occurred within recent years will be longer remembered for its severity. This storm differed from the said "blizzard" in that it prevailed at a much lower temperature, and being much colder it was accompanied by a heavy fall of dry snow, and the telegraph service apparently suffered no impairment.

Michigan.—The mean temperature of the State for the current month was 8.5° below the normal, being one of the coldest Februaries on record, especially in the upper peninsula, where the departures from the normal have been very marked, and the lowest mean monthly temperatures for ten years past have been recorded. Both 1875 and 1885 had cold Februaries, and the February of 1895 was about as cold. Average precipitation over the State was 1.77 inch below the normal.

Mississippi.—The records for the month show this to have been the coldest February ever known in this State since records have been kept. The mean temperature for the month was 11.6° below the normal. The total precipitation averaged 3.08 below the normal. Snowfall averaging about 5 inches in depth occurred over the entire State on the 12th, 13th, 15th, and 16th; it was, however, very unevenly distributed, many stations reporting the heaviest fall that had been known for a long number of years, while others report the fall very light.

Missouri.—This month goes on record as the coldest February that has been experienced in Missouri since 1885, and in the southeastern portion of the State for a much longer period; at St. Louis the month was the coldest since February, 1856. The month was unusually dry in all sections. Over the greater part of the State wheat was well protected by snow during the severe cold weather of the first decade, but peaches have been seriously injured, and in some localities they are reported to be entirely killed. The melting of the heavy snows, together with the light rains during the latter part of the month, increased the supply of stock water, but it is still scarce in some localities.

During the prevalence of the high northwesterly winds on the 6th and 7th, a considerable quantity of dust or fine black sand was deposited over the southwestern portion of the State, and as the ground for many miles to the westward was covered with sleet and snow to a considerable depth, it is believed that this dust was brought by the wind from the prairies of Kansas and Nebraska. The deposit of dust was reported from stations as far southeast as Taney County, and Mr. S. C. Turnbo, observer at Keesees Ferry, Ark. (near Protom, Taney County), in describing the phenomenon says: "I have been reared in this county and am nearly 51 years old, and never knew such an occurrence before." [See January Review, page 15.]

Montana.—The temperature for the current month was about 4° above the normal. Precipitation about 0.17 of an inch above the normal.

Nebraska.—This was a cold month, with rather more than the average precipitation.

Nevada.—The temperature and precipitation for this month were both slightly below the normal. The snowfall was in excess of the amount which usually falls in this month, the mean fall being 11.1 inches.

New England.—The average temperature of the month was 4.5° below the normal. The precipitation was all in the form of snow at most stations, and the greater part of it came in the storm of the 7-8th. Although the snowfall was less than usual, the ground has been well covered throughout the month, and lumbermen have generally had a splendid winter for work. Winter grains and grass roots are pronounced in good condition.

New Jersey.—The mean of the current month was 7.9° below the normal; the average precipitation 2.18 below the normal. Snow was quite general throughout the State, the heaviest occurring during the "blizzard" of the 7th and 8th, when travel was almost entirely suspended by the great drifts. About the only rainfall during the month was on the 28th and was very light. The record for Newark, N. J., shows that only four Februaries during the last fifty-one years have given us a lower mean temperature than that of the one just closed. The coldest

February of which we have any record was that of 1868, with its mean temperature of 21.8°; that of 1855 gave us a minimum of 8° below zero, while the month just closed gave us a minimum of 4° below on the 6th.

New Mexico.—The past month was a record breaker for low temperatures, and will long be remembered as the coldest February in many years. The precipitation was above the normal and rather unevenly distributed.

North Carolina.—The current month was the coldest on record during the past quarter of a century; the mean for the whole State is the lowest for any month during that period, excepting January, 1893, which is 1.9° colder. The precipitation was 1.83 inch below the normal, but occurred mostly as snow and sleet, much of which remained unmelted on the frozen ground for nearly three weeks. The last five or six days of the month were pleasant and warm. The covering of snow is thought to have protected the wheat crops, and unless March is unreasonably warm there will be a fine fruit crop in North Carolina this year. The observer at Linville writes: "Temperature 16° below zero on the morning of the 8th, and the coldest known here; houses not calculated for such extraordinarily cold weather, which, however, was not felt as severely as it would have been at low altitudes on account of the dry air."

North Dakota.—The month has been nearly an average one as far as temperature is concerned, the departure from normal being only three-tenths of a degree below the usual temperature. The first ten days of the month were very severe, but after that time it was, as a general thing, mild and pleasant.

Ohio.—The month averaged 10.6° below the normal, and, with the exception of February, 1885, was the coldest February on record. Cold waves culminated on the 1st, 4th, and 8th, the latter producing the lowest temperatures of the month. The precipitation for the month was 3.01 inches below the average, and was the least monthly precipitation for February on record since the opening of the service. The percentage of verification of weather forecasts received from Washington and distributed to 120 points by telegraph and 800 by postal card was 90 for temperature and 93 for weather. All cold warnings were fully justified, and were of great benefit to the people of the State.

Oklahoma.—During the past month the average temperature was but 29.5°, or 9° below normal. On the 7th the average for the day was zero, which was the coldest weather ever recorded in February, and the coldest single day ever recorded in any month. Less precipitation fell in February than in any other month.

Pennsylvania.—With the exception of 1885, this was the coldest February in the past twenty years. Not only were unusually low temperatures recorded on the 6th, but the month was uniformly cold. The navigation of the Delaware River was practically closed for days to shipping. Many persons crossed the river on the ice between Philadelphia and Camden.

South Carolina.—The current month was an unusually cold one; in many instances it was reported as the coldest on record and as having the longest continuous freezing weather of which record has ever been made in this State. In the central portion of the State ice formed to a thickness of 0.5 inch, and in the southern portions ice formed on rivers that were never before known to freeze. The precipitation averaged 84 per cent of the usual amount. Farm work was greatly delayed. But little plowing could be done until near the end of the month, and then only on hilly and well-drained lands. The heavy snowfall of the 11-12th nearly all remained on the ground for about a week in the central portion of the State and protected grain crops, except that oats were badly damaged by the previous severe freezes.

South Dakota.—The mean temperature of the month was about 4.0° below the normal. The first decade of the month was very cold, with

the daily mean temperature below zero over most of the State. After the 15th it was comparatively mild. The 7th was the coldest of the winter, the average mean temperature of the four regular Weather Bureau stations for that day being 18° below zero. The greater part of the month cattle fed on the ranges over most of the State.

Tennessee.—The month of February, 1895, was phenomenally cold and dry. Snow covered the ground during the greater part of the month, affording valuable protection for wheat, which is now reported in excellent condition and growing well. The severe weather has doubtless caused much suffering to man and beast, but aside from this it has been beneficial to agricultural interests, in that it has killed off many insects and germs injurious both to vegetation and health. It has mellowed up the soil by prolonged freezing, so that it now responds readily to the plow; it has kept back the sap in fruit trees, so that our prospects for a good crop are brighter than for years. The precipitation, which has been unusually light, was almost entirely in the form of snow, which was well and evenly distributed throughout the State.

Texas.—The principal event of the month was the blizzard and weather of February 6-9th. An article by Dr. Cline states that notice of the approach of the norther was telegraphed or mailed to about 600 towns in Texas early enough to enable the citizens to protect their property. The prediction of high northerly wind for Galveston was utilized by the small vessels, and no damage of consequence was noted.

Utah.—This was an uneventful month. The weather throughout the Territory was generally clear and moderately warm, with light wind and about the average amount of precipitation. The average precipitation was slightly below the February normal.

Virginia.—Comparing records of Norfolk, Lynchburg, and Washington, D. C., we find this to have been the coldest February since the commencement of Weather Bureau records in 1871, and that the deficit was greatest in the southern sections of the State. Rains occurred on and near the coast on the 2d, 16th, and 19th; otherwise the total amounts of precipitation recorded for the State are about 40 to 65 per cent below the normal. The snow on the ground proved a great protection generally to winter crops until about the 25th, and then rapidly disappeared with warm weather. Preparation and burning of tobacco beds were being carried on in many sections the last days of February, and some plowing in progress.

Washington.—This has been a month of remarkably fine winter weather in this State. It was, on the whole, very much like February of 1893, although not quite so free from rain and slightly warmer. The amount of precipitation was 1 inch less than the average of six years, and the mean monthly temperature was 4.5° above the average. In western Washington some plowing and seeding was done in the warmer sections; flowers bloomed in the gardens and willow catkins opened in the forests; grasses and ferns remained green throughout the month. On the eastern side of the Cascade range spring-like conditions also prevailed. Some seeding was done; there was plenty of sunshine and flowers; larks and robins were reported. There were no storms during the month severe enough to do any damage.

West Virginia.—This has been an abnormally cold month, the coldest portion being from the 6th to the 11th, inclusive, temperatures below zero being recorded at nearly all stations on most of those dates. Precipitation, while deficient, fell in the form of snow and was unusually heavy in some localities.

Wisconsin.—This has been the coldest February since the establishment of the State Weather Service, and the Weather Bureau records at the Milwaukee station show but two instances where the monthly mean temperature for February was as low as during the past month. It is a fact worthy of note that the three coldest Februaries since 1871 occurred in regular order by decades, as follows; 1875, 1885, 1895. The average precipitation was 0.98 below the normal for February.

STUDIES BY FORECAST OFFICIALS.

As a preliminary to active duty, the forecast officials are given subjects for investigation from time to time. The following paper will be found of interest to all students of the problem of making weather forecasts:

A STUDY OF STORMS IN TEXAS.

By Prof. H. A. Hazen (dated January 29, 1894).

The following is "An examination of the low areas which formed over Texas, or on the Texas coast, during October, November, and December, with a view of determining the conditions which preceded their development, their probable movement, and the time required for the weather conditions attending them to extend to the Atlantic coast."

At the very first of this study it was found that the low areas which formed in Texas, or on the coast, were very few,

and it was decided to add a study of all cases of rainfall which began in Texas. It is easy to see that, after all, what is most needed is a study of the occurrence of rain, and it was found that nearly half the cases in October, and almost as many in November, were with an advancing high area. The maps studied were those prepared in the Forecast Division for the years 1880-'88, inclusive, making nearly 2,400 maps. Some puzzling cases of rainfall were found at Brownsville, and, to elucidate these, all the observations made at Tlacotalpan, in Mexico, on the Gulf of Mexico, were studied in connection with the United States maps. The motions of lower and upper clouds were also studied to determine their influence, if any.

In going through the maps copious notes were made of each map under study, and while these have been freely used in